

*Final*

**UNDERGROUND INJECTION CONTROL  
PERMIT APPLICATION**

**Ute Tribal # 03-05  
2871' FNL & 752' FWL  
Sec. 3, T5S-R3W  
Duchesne County, Utah  
API # 43-013-34289**

July 2015

Prepared for:  
Bruce Suchomel  
Groundwater Program, Mail Code 8P-W-UIC  
U.S. Environmental Protection Agency  
1595 Wynkoop St  
Denver, CO 80202-1129

Prepared by:  
Petroglyph Energy, INC.  
960 Broadway Avenue, Suite 500, P.O. Box 70019  
Boise, Idaho 83707  
(208) 685-7600  
FAX (208) 685-7605

*Triv 2*

**UNDERGROUND INJECTION CONTROL  
PERMIT APPLICATION**

o CBLs For AOR wells  
o Depth to USDW  
o JUDRY REPORTS

03-05

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## **LIST OF ATTACHMENTS**

Attachment No. 1	Area Topography Map
Attachment No. 2	Site Map
Attachment No. 3	Map of the A-Marker surface
Attachment No. 4	Cross-Sections of the injection formation
Attachment No. 5	Water Analysis
Attachment No. 6	Completion data for all wells in the AOR
Attachment No. 7	CBL for the UIC well
Attachment No. 8	Open hole log for the UIC well
Attachment No. 9	List of owners and Affidavit Notification
Attachment No. 10	Well bore diagrams for the UIC well
Attachment No. 11	P&A procedure
Attachment No. 12	MIT procedure
Attachment No. 13	Surety Bond letter

**SUMMARY DOCUMENT  
UIC WELL APPLICATION  
Ute Tribal 03-05  
API # 43-013-34289**

The following document contains information provided in support of the application for the conversion of the Ute Tribal 03-05 well to an injection well in the Green River formation in the Antelope Creek Field in Duchesne County, Utah.

The Antelope Creek Field falls within the Uintah and Ouray Indian reservations and is within Indian Country; therefore, for facilities located on the reservation, only EPA-issued UIC permits are necessary for compliance with UIC regulations.

The EPA has issued an Area Permit #UT20736-00000 for the Underground Injection Control for the Antelope Creek Field. This area permit allows for additional producing wells to be converted to injection wells for enhanced recovery.

- (1) Petroglyph Energy, Inc. (Petroglyph) is the operator and only working interest owner of wells located in the Antelope creek Field, Duchesne County, Utah. Petroglyph's business address is provided below:

Petroglyph Energy, Inc.  
960 Broadway Avenue, Suite 500  
P.O. Box 70019  
Boise, ID 83707

- (2) Enclosed as Attachment No. 1 is a topographic map of a portion of the Antelope Creek Field, identifying all wells located in this area. The legal location for the Ute Tribal 03-05 is 2871' FNL & 752' FWL Lot 12 Sec. 3, T5S-R3W.
- (3) Attachment No. 2 is a map of the well. This map shows a circle with a ¼ mile radius centered on the Ute Tribal 03-05 well. The ¼ mile radius encompasses the area of review, AOR, within which Petroglyph is required to investigate all wells for mechanical integrity. The ¼ mile radius also identifies mineral ownership; all lands within the AOR are leased to Petroglyph by the Ute Tribal as indicated by yellow shading. The AOR has Ute Tribal 04-08 and Ute Tribal 03-12 well(s) located in its ¼ mile radius.



- (4) Petroglyph proposes to utilize the Ute Tribal 03-05 as an injection well for enhanced recovery in the Antelope Creek Field.
- (5) Injection Zone – The injection intervals are between 4169' and 6150' True Vertical Depth and located in the lower portion of the Green River Formation. The injection zone is confined within a 1981' section between the Green River "A" Lime marker bed and the top of the Basal Carbonate in the lower part of the formation. The injection zone is composed of lenticular calcareous sandstones interbedded with low permeable carbonates and calcareous shales. The lenticular sandstones vary in thickness from 1 to 30 feet.

Confining Zone – The overall confining strata above the injection zone consists of impermeable Green River calcareous shales and continuous beds of microcrystalline dolostone. The confining zone in the Ute Tribal 03-05 is 249 feet thick.

Attachment No. 3 is a structure map of the A-Marker surface.

Attachment No. 4 is a cross-section of the injection interval and confining zone.

- (6) Enclosed as Attachment No. 5 are standard analyses of produced water from three batteries that currently serve as central handling facilities for all project producing wells. The analysis of the Green River formation water from the Ute Tribal 18-08 Satellite Battery is 12805 mg/L of total dissolved solids (TDS), Ute Tribal 21-11 Satellite Battery is 15659 mg/L TDS, and Ute Tribal 34-12-D3 Satellite Battery is 14590 mg/L TDS.

Injectate in the field is a mixture of produced water and fresh make-up water. The nearest injection well is the Ute Tribal 03-14, the most recent analysis of the water being injected into the Green River formation at this location is 6393 mg/L TDS. This analysis is also included in Attachment No. 5.

- (7) A summary of completion data from the Ute Tribal 03-05 and offset wells in the AOR are included in Attachment No. 6
- (8) The cement bond log is included in Attachment No. 7.
- (9) The open hole log for the Ute Tribal 03-05 is included in Attachment No. 8.

(10) The Antelope Creek Field is operated under a Cooperative Plan of Development between the Ute Tribe and Petroglyph Energy. At the Ute Tribal 03-05 location, all mineral owners, surface owners and operators located within the AOR ¼ mile radius have been notified of the submitted EPA application to convert to injection. Attachment No. 9 is the Affidavit of Notification to all owners.

(11) Petroglyph requests a maximum surface injection pressure of **1900psi**. The EPA Area Permit No. UT20736-00000 uses the formula:

$$P_m = (0.88\text{psi/ft} - 0.43\text{psi/ft}(S_g)) D$$

Where:

$P_m$  = Maximum surface injection pressure

0.88psi/ft = Fracture gradient

$D$  = Top perforation depth

0.43psi/ft = Hydrostatic pressure/hydraulic head

$S_g$  = Specific gravity of injection fluid

For the Ute Tribal 03-05:

$$\mathbf{1958\text{psi} = (0.88\text{psi/ft} - 0.43(1.00)) 4351\text{ft}}$$

EPA Area Permit No. 20736-00000 further caps maximum surface pressure at 1900psi.

(12) Three wellbore diagrams for the Ute Tribal 03-05 are in Attachment No. 10. One diagram is for production, one for injection, and one for Plug & Abandonment (P&A).

(13) The P&A procedure for this well is shown in Attachment No. 11.

(14) Once the draft permit is issued, Petroglyph will conduct a Mechanical Integrity Test and a static bottom-hole pressure test. The MIT procedure is contained in Attachment No. 12. The conversion work will be satisfactorily completed and submitted to the EPA on Form 7520-12. A wellbore schematic will be included with this form.

- (15) Petroglyph will give proof of financial responsibility by posting a surety bond for the UIC well prior to final permit approval. A copy of this letter is contained in Attachment No. 13.
- (16) Petroglyph will install various gauges on the well so that the injection pressure and tubing/casing annulus pressure can be monitored. The well will be equipped with a flow meter with a cumulative volume recorder.

## Ute Tribal 03-05 Well History

### Well History:

Spud Well: 6/30/2010  
 Completed: 7/26/2010  
 First Production: 7/27/2010

### Tops (KB):

**BMSW\* Found at 923' MD, 922' TVD**  
 Green River 1471' MD, 1462' TVD  
**A Marker 4207' MD, 4169' TVD**  
 X Marker 4704' MD, 4665' TVD  
 Douglas Creek 4856' MD, 4817' TVD  
 B Limestone 5259' MD, 5220' TVD  
 Castle Peak 5762' MD, 5723' TVD  
**Basal Carbonate 6190' MD, 6150' TVD**

### Perf History:

7/15/2010 (MD)

B05	4351' to 4363'
C08.1	5121' to 5130'
D3	5336' to 5352'
E01.1	5825' to 5836'
E06	6093' to 6101'

Petroglyph Operating Co., Inc.

Ute Tribal #03-05

SHL: Lot 12, 2871' FNL & 752' FWL

BHL: Lot 12, 2340' FNL & 684' FWL

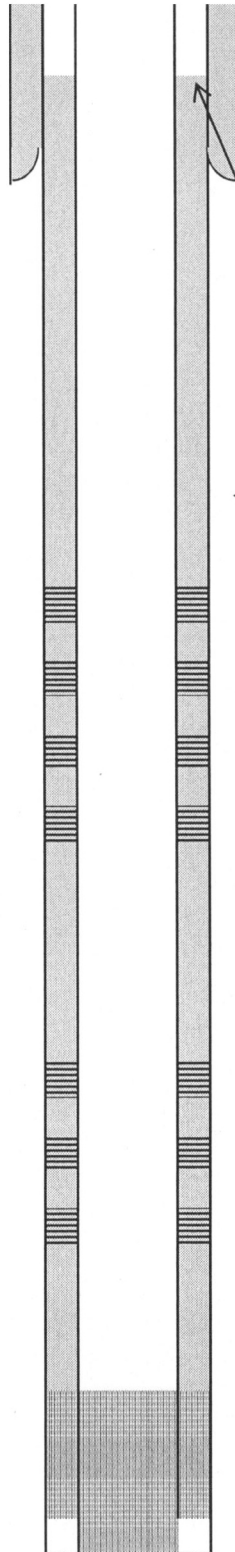
Section 3, 5S- 3W

Antelope Creek Field

Duchesne Co. Utah

API#: 43013342890000

\*Plate 1 Utah Geological Survey Special Study 144.  
 (2012). BMSW Elevation Contour Map, Uinta Basin,  
 Utah, Plate 1 [map]. (CA 1:200,000)



GL: 5909'

KB: 5923'

8 5/8" 24# Surface CSG @ 512' KB

cmt'd w/220 sx

Surface Hole size 12 1/4"

Cement top @ 160'

5 1/2" 15.5# J-55 CSG @ 6472' MD, 6432' TVD

cmt'd w/1105 sx

← Hole Size 7 7/8" bit

Perf's MD:

B05 4351' to 4363'

C08.1 5121' to 5130'

D3 5336' to 5352'

E01.1 5825' to 5836'

E06 6093' to 6101'

PBTD @ 6395' MD KB, 6355' TVD KB

TD @ 6474' MD KB, 6434' TVD KB

(Not to Scale)

## Ute Tribal 03-05 Injection

### Well History:

Spud Well: 6/30/2010

Completed: 7/26/2010

First Production: 7/27/2010

### Tops (KB)

**BMSW\* Found at 923' MD, 922' TVD**

Green River 1471' MD, 1462' TVD

**A Marker 4207' MD, 4169' TVD**

X Marker 4704' MD, 4665' TVD

Douglas Creek 4856' MD, 4817' TVD

B Limestone 5259' MD, 5220' TVD

Castle Peak 5762' MD, 5723' TVD

**Basal Carbonate 6190' MD, 6150' TVD**

Injection Packer @ 4261' MD, 4222' TVD

Petroglyph Operating Co., Inc.

Ute Tribal #03-05

SHL: Lot 12, 2871' FNL & 752' FWL

BHL: Lot 12, 2340' FNL & 684' FWL

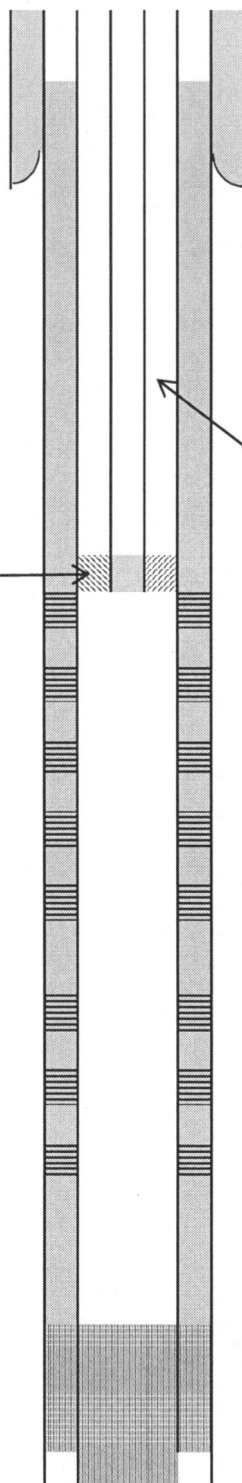
Section 3, 5S- 3W

Antelope Creek Field

Duchesne Co. Utah

API#: 43013342890000

\*Plate 1 Utah Geological Survey Special Study 144.  
(2012). BMSW Elevation Contour Map, Uinta Basin,  
Utah, Plate 1 [map]. (CA 1:200,000)



(Not to Scale)

GL: 5909'

KB: 5923'

8 5/8" 24# Surface CSG @ 512' KB

cmt'd w/220 sx

Surface Hole size 12 1/4"

Hole Size 7 7/8" bit

Cement top @ 160'

5 1/2" 15.5# J-55 CSG @ 6472' MD, 6432' TVD

cmt'd w/1105 sx

Tubing 2 7/8" 6.5# J55

Perf's MD:

B05 4351' to 4363'

Add B07.2 4505' to 4508'

Add C4 4883' to 4885'

C08.1 5121' to 5130'

D3 5336' to 5352'

E01.1 5825' to 5836'

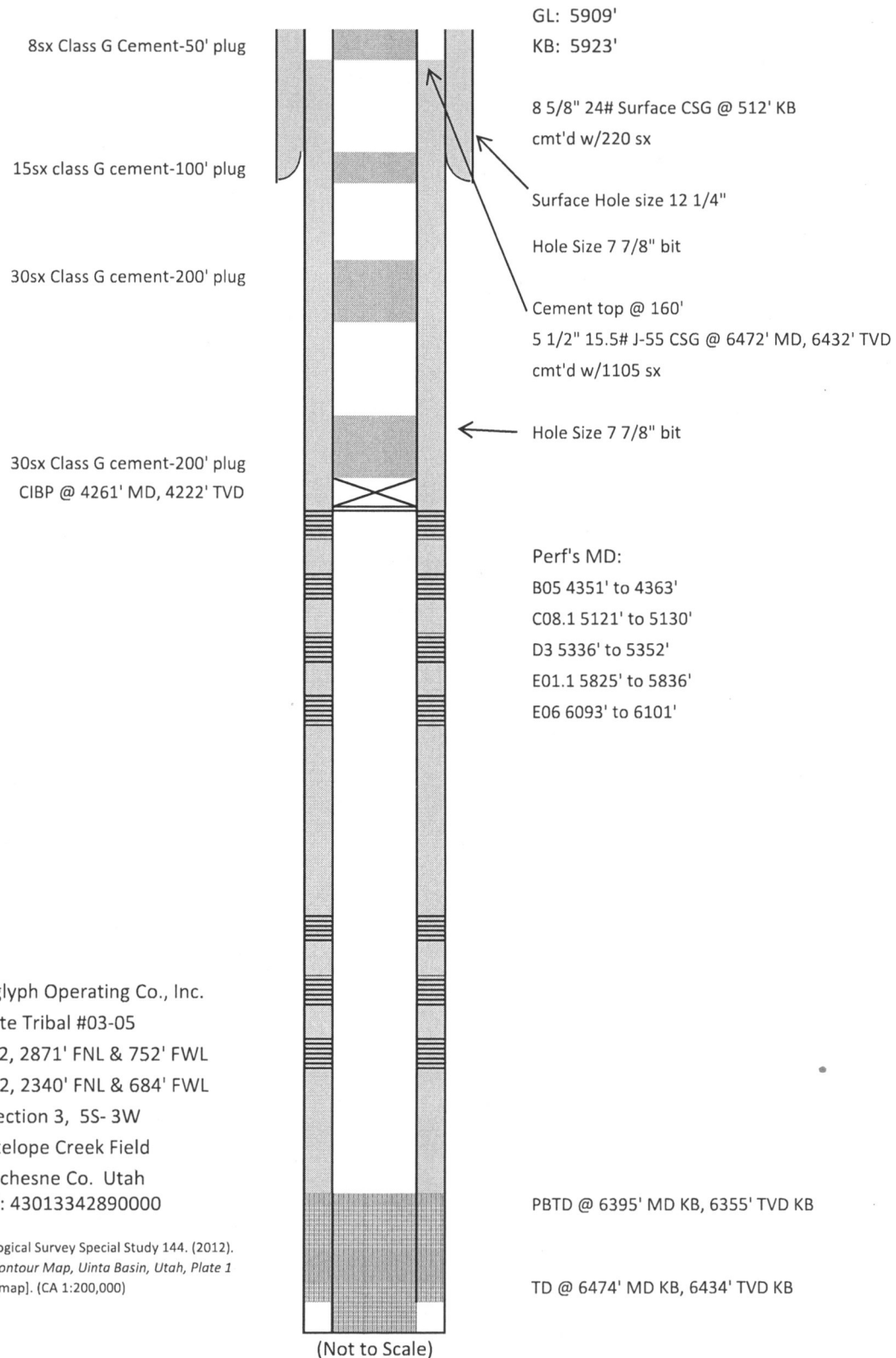
Add E01.2 5858' to 5860

E06 6093' to 6101'

PBTD @ 6395' MD KB, 6355' TVD KB

TD @ 6474' MD KB, 6434' TVD KB

## Ute Tribal 03-05 Plug and Abandonment



Petroglyph Operating Co., Inc.

Ute Tribal #03-05

SHL: Lot 12, 2871' FNL & 752' FWL

BHL: Lot 12, 2340' FNL & 684' FWL

Section 3, 5S- 3W

Antelope Creek Field

Duchesne Co. Utah

API#: 43013342890000

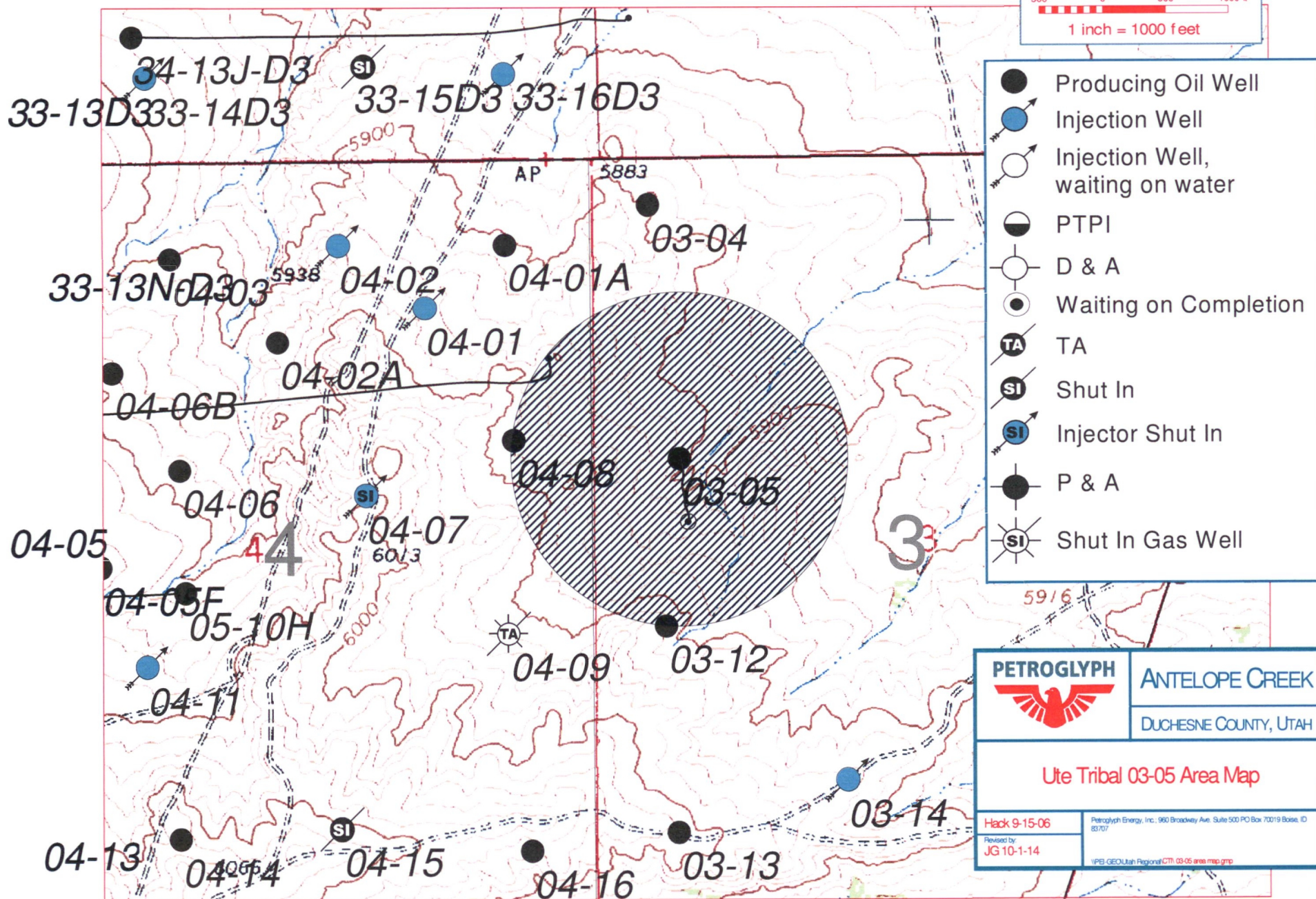
\*Plate 1 Utah Geological Survey Special Study 144. (2012).  
BMSW Elevation Contour Map, Uinta Basin, Utah, Plate 1  
[map]. (CA 1:200,000)



1:12000

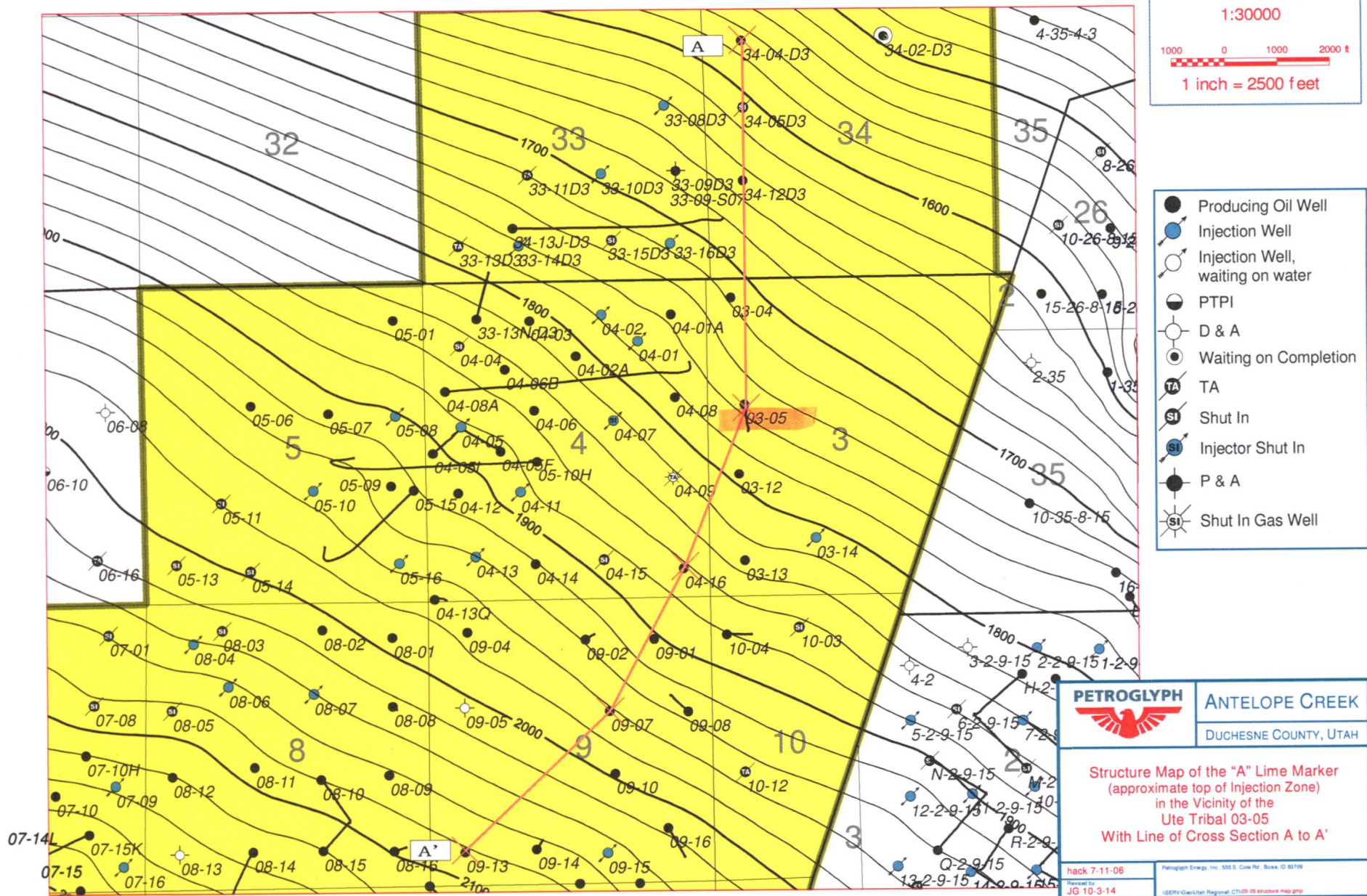
500 0 500 1000 ft

1 inch = 1000 feet





# ATTACHMENT NO. 3: Map of the "A" Lime Marker





~~Now Old Production~~

# Technical Review Worksheet

Permit No: UT2

Well: UT 03-05

What Needs to be Done	Information Sources	Review & Evaluation Notes
Determine name, top and base of the confining zone(s) and the injection zone(s).	<input type="checkbox"/> Geologic data submitted <input type="checkbox"/> Well logs from area <input type="checkbox"/> Published articles	Conf Zone: top <u>3956</u> base <u>4207</u> Inj Zone: top <u>4207</u> base <u>6190</u> (Garden Gulch 2-Marker) (top Wasatch)
Determine name, top and base of all USDWs. List base of lowermost USDW: Determine which USDWs are actually being used for water supply.	<input type="checkbox"/> Geologic data submitted <input type="checkbox"/> nearby Water analyses <input type="checkbox"/> nearby Well logs <input type="checkbox"/> Water supply wells <input type="checkbox"/> Published articles	Surface Elevation: <u>615909 KB 5923</u> Pub #92 base USDW: bgs: elev: submitted base USDW bgs: <u>923 MD</u> elev: <u>922 TVD</u> base of Uinta / top Green River: <u>1471 MD</u> <u>1462 TVD</u>
Review and evaluate construction, casing and cementing records of proposed well.	<input type="checkbox"/> Data submitted <input type="checkbox"/> Completion/workover reports <input type="checkbox"/> Contractor invoices <input type="checkbox"/> Logs: CBL, RTS, Temp, casing inspection, etc.	TD: PBDT: surface csg <u>8 7/8" 24#</u> ft <u>0-512 KB</u> s: long strg csg <u>5 1/2" 15.5#</u> ft <u>0-6472 MD</u> s: <u>0-6432 TVD</u> TOC: submitted <u>160</u> CBL: <u>160</u> Wells in AOR: TD TOC C <u>04-08</u> <u>6462</u> <u>2560</u> <u>03-12</u> <u>5963</u> <u>2290</u> <u>04-08A DEV.</u>
Review and evaluate construction, casing and cementing records of AOR wells that penetrate injection zone.	<p><u>72/2</u> <u>4.1 ≈ 80%</u></p>	
Review P&A plan for effective USDW protection, injection zone isolation and well closure.	<input type="checkbox"/> P&A plan <input type="checkbox"/> Area geology	plug depths:
Review amount of FR - is it adequate to cover P&A costs of proposed in P&A plan?	<input type="checkbox"/> contractor bids / P&A cost histories <input type="checkbox"/> nearby well P&A costs	FR instrument: Amount: \$
Calculate the maximum allowable injection pressure (MAIP).	<input type="checkbox"/> Fracture treatments <input type="checkbox"/> Step Rate Test results <input type="checkbox"/> Fracture gradient	top perforation: <u>4351 MD</u> bottom perforation: <u>6101</u> injectate specific gravity: <u>1.01</u> Frac Gradient: <u>.88</u> p: initial MAIP = <u>1860</u> psi
Determine which logs and tests will be performed.		

## Cement Bond Index (in millivolts - mV)

Date: September 3, 2015

Operator: Petroglyph

Well: Ute Tribal 03-05

Permit: \_\_\_\_\_

Enter the following values:

Amplitude at 0% Bond (A-0) (in mV) = 72 mV

Amplitude at 100% Bond (A-100) (in mV) = 2 mV

Amplitude at 80% Bond (A-80) = 4.1 mV

$$[(0.2)\log A_0 + (0.8)\log A_{100}]$$

Amplitude at 90% Bond (A-90) = 2.9 mV

$$[(0.1)\log A_0 + (0.9)\log A_{100}]$$

80% OK

Amplitude at 70% Bond (A-70) = 5.9 mV

$$[(0.3)\log A_0 + (0.7)\log A_{100}]$$

Amplitude at 60% Bond (A-60) = 8.4 mV

$$[(0.4)\log A_0 + (0.6)\log A_{100}]$$

***Maximum Allowable Injection Pressure (MAIP)***  
***From Fracture Gradient***

Date: 09/03/2015      Operator: Petroglyph  
Well: Ute Tribal 03-05  
Permit #: \_\_\_\_\_

***Enter the following values:***

Specific Gravity of injectate =	<u>1.010</u>	g/cc
Depth to top of injection interval =	<u>4,207</u>	feet
Fracture Gradient ( F G ) =	<u>0.880</u>	psi/ft

***MAIP =***      **1,860**      psig

*(rounded down to nearest 5 psig)*

*where:*

$$MSIP = [FG - (0.433 * SG)] * \text{Depth to top of injection interval} = 1862.313$$

# Structural Cross Section A to A' in the Vicinity of Ute Tribal 03-05

43013515540000 6852 ft 43013342890000 3186 ft 43013512130000 3035 ft 43013515210000 3722 ft 43013511990000

PETROGLYPH OPERATING COMPANY  
UTE TRIBAL 34-04-D3  
660 FNL 762 FWL  
TWP: 4 S - Range: 3 W - Sec. 34

PETROGLYPH OPERATING COMPANY INC  
**UTE TRIBAL 03-05**  
2871 FNL 752 FWL  
TWP: 5 S - Range: 3 W - Sec. 3

PETROGLYPH OPERATING COMPANY  
UTE TRIBAL 04-16  
589 FSL 480 FEL  
TWP: 5 S - Range: 3 W - Sec. 4

PETROGLYPH OPERATING COMPANY  
UTE TRIBAL 09-07  
2087 FNL 1910 FEL  
TWP: 5 S - Range: 3 W - Sec. 9

PETROGLYPH OPERATING COMPANY  
UTE TRIBAL 09-13  
650 FSL 657 FWL  
TWP: 5 S - Range: 3 W - Sec. 9

The cross-section displays several geological layers: a top layer of sandstone (hatched), followed by a thick section of shale (blue), and a base layer of sandstone (hatched). A red line indicates the ground surface. Well data is provided for five wells, showing depth (ft) and formation (FNL/FSL/FWL). The cross-section is oriented A to A'.

Well	Depth (ft)	Formation
UTE TRIBAL 03-05	2871	FNL 752 FWL
UTE TRIBAL 04-16	589	FSL 480 FEL
UTE TRIBAL 09-07	2087	FNL 1910 FEL
UTE TRIBAL 09-13	650	FSL 657 FWL